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**UTILITY  
PATENT APPLICATION  
TRANSMITTAL**

*(Only for new nonprovisional applications under 37 CFR 1.53(b))*

## **APPLICATION ELEMENTS**

1.  Fee Transmittal Form  
*(Submit an original, and a duplicate for fee processing)*

2.  Specification [Total Pages 32] *[preferred arrangement set forth below]*

  - Descriptive title of the Invention
  - Cross References to Related Application
  - Statement Regarding Fed sponsored R & D
  - Reference to Microfiche Appendix
  - Background of the Invention
  - Brief Summary of the Invention
  - Brief Description of the Drawings *(if filed)*
  - Detailed Description
  - Claim(s)
  - Abstract of the Disclosure

3.  Drawing(s) *(35 USC 113)* [Total Sheets 12] *J*

4. Oath or Declaration [Total Pages 4] *J*

  - a.  Newly executed (original or copy)
  - b.  Copy from a prior application *(37 CFR 1.63(d))*  
*(for continuation /divisional with Box 17 completed)*  
[Note Box 5 below]
  - i.  DELETION OF INVENTOR(S)  
Signed statement attached deleting inventor(s) named in prior application, see 37 CFR 1.63(d)(2) and 1.33(b).

5.  Incorporation by Reference *(useable if Box 4b is checked)*  
The entire disclosure of the prior application, from which a copy of the oath or declaration is supplied under Box 4b is considered as being part of the disclosure of the accompanying application and is hereby incorporated by reference therein.

Attorney Docket No.	ST9-99-151	Total Pages	59
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HongHai Shen			S. S.
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## **APPLICATION ELEMENTS**

*See MPEP chapter 600 concerning utility patent application contents.*

6.  Microfiche Computer Program (*Appendix*)

7. Nucleotide and/or Amino Acid Sequence Submission (*if applicable, all necessary*)

  - a.  Computer Readable Copy
  - b.  Paper Copy (identical to computer copy)
  - c.  Statement verifying identify of above copies

**ACCOMPANYING APPLICATION PARTS**

8.  Assignment Papers (cover sheet & document(s))

9.  37 CFR 3.73(b) Statement  Power of Attorney  
(when there is an assignee)

10.  English Translation Document (*if applicable*)

11.  Information Disclosure Statement (IDS)/PTO-1449  Copies of IDS Citations

12.  Preliminary Amendment

13.  Return Receipt Postcard (MPEP 503)  
*(Should be specifically itemized)*

14.  Small Entity  Statement filed in prior application,  
Statement(s) Status still proper and desired

15.  Certified Copy of Priority Document(s)  
*if foreign priority is claimed)*

16.  Other: Express Mail Certificate

17. If a **CONTINUING APPLICATION**, check appropriate box and supply the requisite information.

Continuation     Divisional     Continuation-in-part (CIP)     Correction/Clarification

**18 CORRESPONDENCE ADDRESS**

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PATENT APPLICATION  
Docket No.: ST9-99-151

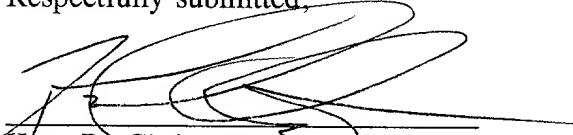
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I hereby certify that this patent application in the name of HongHai Shen and Yudong Sun for PROVIDING DYNAMIC WEB PAGES BY SEPARATING SCRIPTS AND HTML CODE, together with the drawings, a Utility Application Cover Sheet, a joint signature Declaration, Power of Attorney, and Petition, an Assignment, a Recordation Form Cover Sheet, an Information Disclosure Statement, PTO Form 1449, Cited References, Fee Transmittal, and Check No. 13095 for \$950.00 are being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 C.F.R. § 1.10 on the date indicated above in an envelope addressed to Box Patent Application, Assistant Commissioner for Patents, Washington, D.C. 20231.

Respectfully submitted,



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Docket No. 3000.2.27  
IBM No. ST9-99-151

**UNITED STATES PATENT APPLICATION**

of

**HONGHAI SHEN**

and

**YUDONG SUN**

for

**PROVIDING DYNAMIC WEB PAGES BY SEPARATING  
SCRIPTS AND HTML CODE**

## PROVIDING DYNAMIC WEB PAGES BY SEPARATING SCRIPTS AND HTML CODE

## BACKGROUND OF THE INVENTION

#### Field of the Invention

The present invention relates generally to programming techniques in the hypertext markup language ("HTML"). More particularly, the present invention relates to a system and method for providing dynamic Web pages by separating scripts and HTML code.

## Identification of Copyright

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## Relevant Technology

The World Wide Web (hereinafter "the Web") is a collection of Internet-accessible servers from which specially formatted documents may be retrieved and displayed by Web browsers, such as Netscape Navigator™ and Microsoft Internet Explorer™. Currently, the hypertext markup language ("HTML") is the most

1 common authoring language for creating Web documents, also known as "Web  
2 pages." A Web page is identified by a uniform resource locator ("URL"), which is  
3 used by a Web browser to locate and display a particular Web page.

4 Until recently, most Web pages were static, i.e. the content of a Web page  
5 was the same each time it was displayed. As a result, to produce customized  
6 content for different users, for example, different Web pages (with different URLs)  
7 were created in advance for each user. Such an approach has obvious shortcomings,  
8 however, since a Web server would need to store millions of different Web pages  
9 for millions of different users.

10 Consequently, techniques were developed to make Web pages dynamic, i.e.  
11 the content of a single Web page may change each time it is viewed. A different  
12 Web page may be displayed depending, for example, on the identity of the reader,  
13 the geography of the reader, the time of day, previous pages viewed by the reader,  
14 and the like.

15 For instance, a user may retrieve a Web page containing her bank account  
16 balance. However, the bank does not typically store individual "account balance"  
17 pages for each user. Instead, user-specific information is retrieved from the bank's  
18 database and dynamically inserted into a Web page template, after which the  
19 resulting Web page is sent to the user's Web browser.

20 Conventionally, dynamic Web pages are created by embedding server-side  
21 scripts in Web pages, which execute on a Web server and generate HTML elements

1 prior to the Web page being sent to a browser. A variety of technologies exist for  
2 producing dynamic HTML pages, including common gateway interface ("CGI")  
3 scripts, active server pages ("ASP"), server-side includes ("SSI"), cookies, Java,  
4 JavaScript, and ActiveX.

5       Unfortunately, embedding server-side scripts within Web pages has at least  
6 two major drawbacks that have plagued Web page developers and HTML  
7 programmers. First, a Web page including embedded scripts cannot be effectively  
8 edited with an interactive HTML editor, because some of the HTML elements of the  
9 page are only generated by the scripts at run time, and are thus unknown to the  
10 editor at design time.

11       Second, Web documents including embedded scripts are often difficult to  
12 maintain and debug since the scripts are typically scattered throughout a Web page  
13 at various locations at which corresponding HTML elements are to be inserted by  
14 a Web server. This fact also makes it difficult to provide a high-level integrated  
15 development environment ("IDE") for script writers and programmers.

16       The above-described problems are more fully illustrated by the following  
17 example. A user may wish to update her personal information on an e-commerce  
18 site, such as Amazon.com™. Accordingly, she may request a dynamic Web page  
19 adapted for that purpose by clicking on a corresponding button displayed by her  
20 Web browser.

1       Figure 1 depicts a conventional dynamic Web page 2 for updating a user's  
2 personal information. As illustrated, the Web page 2 includes a number of  
3 embedded scripts 4. The Web page 2 may be an active server page ("ASP"), as  
4 shown, although other technologies could be used.

5       In general, the embedded scripts 4 are unintelligible to Web browsers and  
6 HTML editors. As such, if the Web page 2 of Figure 1 is displayed by a standard  
7 Web browser or HTML editor, the scripts will be ignored, and a displayed page 2  
8 similar to that of Figure 2 will result.

9       Conventionally, the Web server handing the request modifies the Web page  
10 2 by replacing the scripts 4 of Figure 1 with the output of the script execution (e.g.,  
11 the Write() arguments). Typically, the output includes one or more HTML elements  
12 6, as illustrated in Figure 3. Thereafter, a "modified" Web page 8 may be sent to the  
13 requesting Web browser.

14       For instance, the Web server may replace the script 4A of Figure 1, i.e. <%  
15 Response.Write("<input name='name' value=''" & rs("name") &  
16 " '">" ) %>, with the HTML element 6A of Figure 3, i.e. <input name='name'  
17 value='Jane Doe'>. The rs("name") argument is a database query that  
18 returns, for example, the user's name, i.e. "Jane Doe."

19       The modified Web page 8, as displayed by a Web browser, is shown in  
20 Figure 4. As a result of the above-described process, a single requested Web page  
21

1       2 may produce customized output for different users. In other words, the Web page  
2       2 is "dynamic."

3              Unfortunately, conventional dynamic Web pages 2 of the type illustrated in  
4       Figure 1 have numerous drawbacks. As previously noted, a Web page 2 including  
5       embedded scripts 4 cannot be effectively edited by an HTML editor, because some  
6       HTML elements 6 do not exist until after the scripts 4 are executed, and are thus not  
7       available to the HTML editor at design time.

8              For example, the HTML element 6A, i.e. <input name='name'  
9       value='Jane Doe'>, does not exist in the Web page 2 of Figure 1. The element  
10      6A is not added until after the Web server executes the script 4A. As a result, a  
11      Web designer is limited to the displaying and editing the incomplete Web page 2  
12      of Figure 2, rather than the completed Web page 2 of Figure 4. Designing and  
13      laying out a Web page 2 is understandably difficult when some of the HTML  
14      elements 6 are not available at design time.

15             Moreover, debugging and maintaining conventional dynamic Web pages  
16      2 are difficult, since individual scripts 4 are scattered throughout the pages 2 at  
17      various locations dictated by the insertion points of corresponding HTML elements  
18      6. For instance, the Web page 2 of Figure 1 includes three different scripts 4A-C at  
19      three different locations. Larger Web pages 2 may include hundreds of scripts. The  
20      lack of a single location in which a Web designer may look to find all of the  
21      embedded scripts 4 is a serious problem in Web page development.

1       Accordingly, what is needed is a system and method for providing dynamic  
2       Web pages. What is also needed is a system and method for providing dynamic  
3       Web pages that may be edited by an interactive HTML editor. What is also needed  
4       is a system and method for providing dynamic Web pages by separating scripts and  
5       HTML code.

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2 The present invention solves many or all of the foregoing problems by  
3 introducing a novel system and method for providing dynamic Web pages by  
4 separating scripts and HTML code.

5 In one aspect of the invention, a request reception module may receive a  
6 request for an document stored within document server. The document may be  
7 encoded in the hypertext markup language (HTML) and may include one or more  
8 HTML elements.

After the request is received, a parsing module may parse the requested document to generate therefrom a corresponding document object model (DOM) including at least one object. Each HTML element of the document typically corresponds to one DOM object.

13        After the document is parsed, an instruction obtaining module may obtain  
14        a transformation instruction directed to at least one object of the DOM. A variety  
15        of transformation instructions are possible. For example, one transformation  
16        instruction may retrieve a value from a database and assign the value to a DOM  
17        object. Another transformation instruction may replace one object with a different  
18        object.

19 In another aspect of the invention, the instruction obtaining module may  
20 include a script file access module, which may read a transformation instruction  
21 from a script file corresponding to the requested document. In one embodiment,

1 the script file, including one or more transformation instructions, may be included  
2 within a separate portion of the document. For example, the HTML elements of the  
3 document and the transformation instructions of the script file may be stored within  
4 separate portions of a single logical data file. In another embodiment, however, the  
5 script file and the document may comprise logically separate data files.

6 After the transformation instruction is obtained, an object transformation  
7 module may transform the first object in accordance with the transformation  
8 instruction. Thereafter, a flattening module may flatten the DOM to generate  
9 therefrom a corresponding transformed document.

10 In one embodiment, the transformed document may comprise one or more  
11 HTML elements corresponding to the objects of the DOM. As a result of the  
12 flattening process, any transformation of a DOM object is preferably reflected within  
13 a corresponding HTML element of the transformed document.

14 In yet another aspect of the invention, a transmission module may transmit  
15 the transformed document to a requesting client program. In various embodiments,  
16 the client program may include a standard Web browser.

17 These and other objects, features, and advantages of the present invention  
18 will become more fully apparent from the following description and appended  
19 claims, or may be learned by the practice of the invention as set forth hereinafter.

20  
21

## BRIEF DESCRIPTION OF THE DRAWINGS

The present invention is more fully disclosed in the following specification, with reference to the accompanying drawings, in which:

Figure 1 is an illustration of a Web document;

Figure 2 is an illustration of a screen display produced by a Web browser;

Figure 3 is an illustration of a Web document;

Figure 4 is an illustration of a screen display produced by a Web browser;

Figure 5 is a schematic block diagram of a computer system suitable for

hosting a plurality of software modules according to an embodiment of the invention;

Figure 6 is a schematic block diagram of a system for providing dynamic Web pages according to an embodiment of the invention;

Figure 7 is a schematic flowchart of a method for providing dynamic Web pages according to an embodiment of the invention;

Figure 8 is an illustration of a Web document according to an embodiment of the invention;

Figure 9 is an illustration of a screen display generated by a Web browser according to an embodiment of the invention;

Figure 10 is an illustration of a Document Object Model (DOM) according to an embodiment of the invention;

1       Figure 11 is an illustration of a script file according to an embodiment of the  
2 invention;

3       Figure 12 is an illustration of a DOM according to an embodiment of the  
4 invention;

5       Figure 12 is an illustration of a DOM according to an embodiment of the  
6 invention;

7       Figure 14 is an illustration of a Web document according to an embodiment  
8 of the invention; and

9       Figure 15 is an illustration of a screen display generated by a Web browser  
10 according to an embodiment of the invention.

1

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

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Certain presently preferred embodiments of the invention are now described with reference to the Figures, where like reference numbers indicate identical or functionally similar elements. The components of the present invention, as generally described and illustrated in the Figures, may be implemented in a variety of configurations. Thus, the following more detailed description of the embodiments of the system and method of the present invention, as represented in the Figures, is not intended to limit the scope of the invention, as claimed, but is merely representative of presently preferred embodiments of the invention.

10

Throughout the following description, various system components are referred to as "modules." In certain embodiments, the modules may be implemented as software, hardware, firmware, or any combination thereof.

13

For example, as used herein, a module may include any type of computer instruction or computer executable code located within a memory device and/or transmitted as electronic signals over a system bus or network. An identified module may include, for instance, one or more physical or logical blocks of computer instructions, which may be organized as an object, a procedure, a function, or the like.

19

The identified modules need not be located physically together, but may include disparate instructions stored at different memory locations, which together implement the described logical functionality of the module. Indeed, a module may

1 include a single instruction, or many instructions, and may even be distributed  
2 among several discrete code segments, within different programs, and across  
3 several memory devices.

4       Figure 5 is a schematic block diagram illustrating a computer system 10 in  
5 which a plurality of software modules may be hosted on one or more computer  
6 workstations 12 connected via a network 14. The network 14 may include a wide  
7 area network (WAN) or local area network (LAN) and may also include an  
8 interconnected system of networks, one particular example of which is the Internet.

9       A typical computer workstation 12 may include a central processing unit  
10 (CPU) 16. The CPU 16 may be operably connected to one or more memory devices  
11 18. The memory devices 18 are depicted as including a non-volatile storage device  
12 20 (such as a hard disk drive or CD-ROM drive), a read-only memory (ROM) 22,  
13 and a random access memory (RAM) 24.

14       The computer workstation 12 may operate under the control of an operating  
15 system (OS) 25, such as OS/2®, WINDOWS NT®, WINDOWS®, UNIX®, and the like.  
16 In various embodiments, the OS 25 provides a graphical user interface (GUI).

17       The computer workstation 12 may also include one or more input devices  
18 26, such as a mouse and/or a keyboard, for receiving inputs from a user. Similarly,  
19 one or more output devices 28, such as a monitor and/or a printer, may be provided  
20 within, or be accessible from, the computer workstation 12.

1           A network interface 30, such as an Ethernet adapter, may be provided for  
2 coupling the computer workstation 12 to the network 14. Where the network 14 is  
3 remote from the computer workstation 12, the network interface 30 may include a  
4 modem, and may connect to the network 14 through a local access line, such as a  
5 telephone line.

6           Within any given computer workstation 12, a system bus 32 may operably  
7 interconnect the CPU 16, the memory devices 18, the input devices 26, the output  
8 devices 28, the network interface 30, and one or more additional ports 34, such as  
9 parallel and/or serial ports.

10          The system bus 32 and a network backbone 36 may be regarded as data  
11 carriers. Accordingly, the system bus 32 and the network backbone 36 may be  
12 embodied in numerous configurations, such as wire and/or fiber optic lines, as well  
13 as electromagnetic communication channels using visible light, infrared, and radio  
14 frequencies.

15          The computer workstations 12 may be coupled via the network 14 to  
16 application servers 42, and/or other resources or peripherals 44, such as scanners,  
17 fax machines, and the like. External networks, such as the Internet 40, may be  
18 coupled to the network 14 through a router 38 or firewall.

19          In various embodiments, one or more Web servers 46 may be accessible to  
20 the workstations 12 via the Internet 40. A Web server 46 is a computer system, such  
21 as a workstation 12, including specialized software for delivering (serving) Web

1 pages to Web browsers. A variety of Web server application programs are  
2 available, including public domain software from NCSA and Apache, as well as  
3 commercial packages from Microsoft, Netscape and others.

4 Referring now to Figure 6, a system 50 for providing dynamic Web pages  
5 according to a presently preferred embodiment of invention may include a  
6 workstation 12 and a Web server 46. The workstation 12 may include a conventional  
7 Web browser 52, such as Netscape Navigator™ or Microsoft Internet Explorer™,  
8 which is capable of communicating with the Web server 46 using the hypertext  
9 transfer protocol ("HTTP").

10 The Web server 46 is depicted as including a request reception module 54.  
11 In one embodiment, the request reception module 54 receives (from the Web  
12 browser 52) a request for a document 56 stored within a document storage area 58  
13 of the Web server 46. The document 56 may be encoded in the hypertext markup  
14 language ("HTML") and may include one or more HTML elements 6, as described  
15 more fully hereafter.

16 In one embodiment, the Web server 46 also includes a parsing module 60,  
17 commonly referred to as a "parser." The parsing module 60 retrieves, in various  
18 embodiments, the requested document 56 and parses the document 56 to generate  
19 therefrom a corresponding Document Object Model (DOM) 62, sometimes referred  
20 to as a "parse tree." A DOM 62 is a tree-like, hierarchical data structure including  
21

1 one or more objects 64 that represent the various HTML elements 6 of the document  
2 56.

3 In certain embodiments, the parsing module 60 is a conventional HTML  
4 parser. For example, both Netscape Navigator™ and Microsoft Internet Explorer™  
5 include HTML parsers, which may be adapted, in various embodiments, for use  
6 within the Web server 46. In an alternative embodiment, a custom HTML parser  
7 may be used. Conventionally, however, a Web server 46 does not include a parsing  
8 module 60, since a document 56 is normally parsed only by a Web browser 52 at the  
9 time the document 56 is displayed.

10 The Web server 46 may also include a script file access module 66. In certain  
11 embodiments, the script file access module 66 may be configured to retrieve a script  
12 file 68 (from a script file storage area 70) corresponding to the requested document  
13 56, as explained more fully hereafter.

14 A script file 68 may contain one or more transformation instructions 72 or  
15 "scripts." However, unlike the conventional server-side scripts 4 of Figure 1, each  
16 transformation instruction 72 is directed to at least one object 64 of the DOM 62 and  
17 includes at least one transformation to be performed on the at least one object 64.

18 For example, as described in greater detail below, one transformation  
19 instruction 72 may query a database for a value and assign the value to an object 64  
20 of the DOM 62. Another transformation instruction 72 may replace one object 64  
21 with a different object 64. A wide variety of transformation instructions 72 are

1 possible within the scope of the invention. A transformation instruction 72 may  
2 have any suitable syntax, so long as it identifies at least one object 64 and at least  
3 one transformation.

4 In the depicted embodiment, the script files 68 and the Web documents 56  
5 comprise logically separate data files, and may even be housed within separate  
6 storage areas 58, 70 of the Web server 46. In such an embodiment, a document 56  
7 and a corresponding script file 68 may have identical or similar names, with the  
8 exception of a file extension or other delimiter. For example, if the requested  
9 document 56 is named "personalinfo.html," the corresponding script file 68 may be  
10 named "personalinfo.scr" or the like. Thus, in various embodiments, the request  
11 reception module 54 may identify a corresponding script file 68 for any requested  
12 document 56.

13 In an alternative embodiment, the Web browser 52 may request a script file  
14 68, and the request reception module 54 may identify a corresponding document 56  
15 in like manner. In one embodiment, the script file 68, including one or more  
16 transformation instructions 72, may be included within a separate portion of the  
17 document 56. For example, the HTML elements 6 of the document 56 and the  
18 transformation instructions 72 of the script file 68 may be stored within separate  
19 portions of a single logical data file.

20 In certain presently preferred embodiments, the Web server 46 also includes  
21 a object transformation module 74, which may transform one or more objects 64 of

1 the DOM 62 in accordance with the transformation instruction(s) 72 of a  
2 corresponding script file 68. In various embodiments, the object transformation  
3 module 74 may retrieve each instruction 72 from the script file 68, in sequence, and  
4 performs the requested transformation(s).

5 In the depicted embodiment, the object transformation module 74 includes  
6 a number of supplemental modules for performing various transformation  
7 instructions 74. For example, a database query module 76 may be provided for  
8 performing a specified query on a database 78 to retrieve a value. Likewise, a value  
9 assignment module 80 may be provided for assigning a value to a DOM object 64.  
10 Moreover, an object replacement module 82 may be provided to replace one object  
11 64 of the DOM 62 with another object 64.

12 The Web server 46 may also include a flattening module 84. In various  
13 embodiments, the flattening module 84 flattens the DOM 62 to generate therefrom  
14 a transformed document 86. As used herein, the term "flattening" refers to a  
15 process of converting the DOM 62 back into an equivalent HTML document 86  
16 including one or more corresponding HTML elements 6. Techniques for flattening  
17 a DOM 62 are well known in the art. The resulting document 86 is designated  
18 as "transformed" because any transformations of the DOM objects 64 are preferably  
19 reflected in the corresponding HTML elements 6 of the transformed document 86.

20 In various embodiments, the Web server 46 may also include a transmission  
21 module 88. The transmission module 88 may send the transformed document 86

1 (via the Internet 40) to the Workstation 12, such that the document 86 may be  
2 displayed by the Web browser 52.

3 Referring now to Figure 7, a schematic flowchart includes a method 100 for  
4 providing dynamic Web pages according to a presently preferred embodiment of  
5 the invention. The method 100 may begin by receiving 102, at a Web server 46, a  
6 request for a document 56.

7 Figure 8 illustrates an exemplary document 56 according to an embodiment  
8 of the invention. For purposes of comparison, the document 56 may be configured,  
9 like the Web page 2 of Figure 1, to update a user's personal information on an e-  
10 commerce site, such as Amazon.com™. However, unlike the Web page 2 of Figure  
11 1, the document 56 need not include conventional embedded scripts 4.

12 For example, rather than including a script 4A, as in Figure 1, a regular  
13 HTML element 6D, i.e. <input name='name' value = ''>, may be used. As  
14 illustrated, the element 6D may be similar to the element 6A of Figure 3 (which was  
15 inserted by the Web server after executing the script 4A), except that the "value"  
16 attribute may be left empty.

17 If displayed by a Web browser, the document 56 may appear as shown in  
18 Figure 9. Visually, the displayed document 56 is very similar to that of Figure 4,  
19 with the exception of the customized personal data. Thus, unlike the Web page 2  
20 of Figure 1, the document 56 of Figure 8 may be effectively edited by an HTML  
21 editor, because all of the necessary HTML elements 6 are included. This is a great

1 advantage to Web designers and HTML programmers, who need to edit a  
2 document that is as similar to the desired end product (i.e. Figure 4) as possible.

3 After the document request is received 102, the method 100 may continue  
4 by parsing 104 the document 56 to generate therefrom a corresponding Document  
5 Object Model (DOM) 62. As noted, a DOM 62 is a tree-like, hierarchical data  
6 structure including one or more objects 64 that represent the HTML elements 6 of  
7 the document 56. Figure 10 illustrates a portion of a simplified DOM 62  
8 corresponding to the document 56 of Figure 8.

9 After the document 56 is parsed 104, the method 100 may continue by  
10 identifying 106 a script file 68 corresponding to the document 56. In certain  
11 embodiments, a document 56 and a corresponding script file 68 may have identical  
12 or similar names, with the exception of a file extension or other delimiter. For  
13 example, if the requested document 56 is named "personalinfo.html," the  
14 corresponding script file 68 may be named "personalinfo.scr" or the like.

15 Figure 11 illustrates an exemplary script file 68 in accordance with an  
16 embodiment of the invention. As previously noted, a script file 68 may include one  
17 or more transformation instructions 72. Each transformation instruction may be  
18 directed to at least one object 64 of the DOM 62 and indicate at least one  
19 transformation to be performed on the at least one object 64.

20 While the script file 68 and the document 56 are depicted herein as logically  
21 separate data files, the script file 68 may be included, in some instances, within a

1 separate portion of document 56. For example, all of the transformation instructions  
2 72 of the script file 68 may be located, as a group, at the beginning of the document  
3 56:

```
4 <%  
5   dom.allElements("name").value = rs("name")  
6   dom.allElements("phone").value = rs("phone")  
7   dom.allElements("email").value = rs("email")  
8 %>  
9   <html>  
10  <head>  
11  <title>Personal Information Update</title>  
12  </head>  
13  <body>  
14  <table>  
15  . . .
```

16 The location of the transformation instructions 72 within the document 56 is not  
17 crucial. However, all of the instructions 72 should be located together to avoid the  
18 noted drawbacks of conventional dynamic Web pages 2.

19 After the script file 68 is identified 106, the method 100 may continue by  
20 reading 108 a transformation instruction 72 from the script file 68. Thereafter, the  
21 method 100 may continue by transforming 110 one or more objects 64 of the DOM  
62 in accordance with the read transformation instruction 72.

22 For example, if the first transformation instruction 72A is read, i.e.  
23 dom.allElements("name").value = rs("name"), the method 100 may  
24 proceed to transform the object 64A of Figure 10 by querying a database 78 for a  
25 value, i.e. the user's name, and assigning the value to the object 64A. As previously  
26

1 noted, the "rs" (recordset) argument indicates a database query in one embodiment.  
2 If, for instance, the user's name is "Jane Doe," Figure 12 illustrates the transformed  
3 object 64A within the DOM 62.

4 One advantage of transforming a DOM 62 rather than modifying an Web  
5 document 56, itself, as in conventional approaches, is that the DOM 62 is more easily  
6 transformed than HTML text. For example, any object 64 of the DOM 62 may be  
7 randomly accessed and transformed by a simple command, whereas modifying a  
8 Web document 56 requires more complex manipulations of the HTML text, such as  
9 cutting and pasting HTML elements 6.

10 After the transformation step 110 is complete, the method 100 may continue  
11 by determining 112 whether the script file 68 includes more transformation  
12 instructions 112. If so, the method may returns to step 108 to read the next  
13 instruction 72.

14 If, however, all of the instructions 72 have been used, the method 100  
15 continues by flattening 114 the DOM 62 to create a transformed document 86. As  
16 previously noted, the flattening process involves converting the DOM 62 back into  
17 an HTML document 86. Consequently, any transformations to the DOM objects 64  
18 will be preferably reflected in the corresponding HTML elements 6 of the document  
19 86.

20 For example, Figure 13 illustrates the DOM 62 after execution of the three  
21 transformations instructions 72A-C. After the flattening step 114, the transformed

1 document 86 of Figure 14 may result, which may then be sent 116 to the requesting  
2 Web browser 52 and displayed, as illustrated in Figure 15.

3 Surprisingly, the transformed document 86 is identical to the modified  
4 document 8 of Figure 3, which was produced by conventional techniques using  
5 embedded server-side scripts 4. However, the transformed document 86, in  
6 accordance with an embodiment of the invention, does not rely on embedded  
7 scripts 4. Rather, the transformed document 86 is generated, as noted above, by  
8 parsing a requested document 56 at the Web server 46, transforming the resulting  
9 DOM 62, and flattening the DOM 62 into a "transformed" HTML document 86.

10 Moreover, unlike conventional approaches, the transformation instructions  
11 72 are not "place holders" for HTML elements 6 to be inserted later by a Web server  
12 46. As such, all of the transformations instructions 72 can be located together, even  
13 within a separate script file 68.

14 Importantly, a document 56 in accordance with the present invention may  
15 be effectively edited by an HTML editor, since all of the HTML elements may be  
16 included within the document 56 at design time. Any transformations, such as  
17 assignments of values and the like, may be accomplished by transforming the DOM  
18 62. No embedded scripts 4 are necessary.

19 The present invention may be embodied in other specific forms without  
20 departing from its scope or essential characteristics. The described embodiments  
21 are to be considered in all respects only as illustrative and not restrictive. The scope

1 of the invention is, therefore, indicated by the appended claims rather than by the  
2 foregoing description. All changes which come within the meaning and range of  
3 equivalency of the claims are to be embraced within their scope.

4 What is claimed is:

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## Claims

1. Within a document server, a computer-implemented method for processing a request for a document comprising at least one hypertext markup language (HTML) element, the method comprising:

parsing the requested document to generate therefrom a corresponding document object model (DOM) including at least one object;

obtaining a transformation instruction directed to a first object of the DOM; transforming the first object in accordance with the transformation instruction; and

flattening the DOM to generate therefrom a corresponding transformed document.

2. The method of claim 1, wherein the obtaining step comprises:

reading a transformation instruction from a script file corresponding to the requested document.

3. The method of claim 2, further comprising:

receiving a request for a document from a client program; and

identifying a script file within the document server corresponding to the requested document.

1           4. The method of claim 3, wherein the client program comprises a Web  
2 browser.

3

4           5. The method of claim 2, further comprising:  
5 receiving a request for a script file from a client program; and  
6 identifying a document within the document server corresponding to the  
7 requested script file.

8

9           6. The method of claim 2, wherein the script file is included within a  
10 separate portion of the document.

11

12          7. The method of claim 2, wherein the script file and the document  
13 comprise logically separate data files.

14

15          8. The method of claim 1, further comprising:  
16 transmitting the transformed document to a client program.

17

18          9. The method of claim 1, wherein the transforming step comprises:  
19 retrieving a value from a database; and  
20 assigning the value to an object of the DOM.

1           10. The method of claim 1, wherein the transforming step comprises:  
2           replacing a first object of the DOM with a different second object.

3

4           11. A system for processing a request for a document comprising at least  
5           one hypertext markup language (HTML) element, the system comprising:  
6           a parsing module configured to parse a requested document to generate  
7           therefrom a corresponding document object model (DOM) including  
8           at least one object;  
9           an instruction obtaining module configured to obtain a transformation  
10          instruction directed to a first object of the DOM;  
11          an object transformation module configured to transform the first object in  
12          accordance with the transformation instruction; and  
13          a flattening module configured to flatten the DOM to generate therefrom a  
14          corresponding transformed document.

15

16          12. The system of claim 11, wherein the instruction module comprises:  
17          a script file access module configured to read a transformation instruction  
18          from a script file corresponding to the requested document.

19

20          13. The system of claim 12, further comprising:  
21

1 a request reception module configured to receive a request for a document  
2 from a client program and identify a script file corresponding to the  
3 requested document.

4

5 14. The system of claim 13, wherein the client program comprises a Web  
6 browser.

7

8 15. The system of claim 12, further comprising:  
9 a request reception module configured to receive a request for a script file  
10 from a client program and identify a document corresponding to the  
11 requested script file.

12

13 16. The system of claim 12, wherein the script file is included within a  
14 separate portion of the document.

15

16 17. The system of claim 12, wherein the script file and the document  
17 comprise logically separate data files.

18

19 18. The system of claim 11, further comprising:  
20 a transmission module configured to transmit the transformed document to  
21 a client program.

1           19. The system of claim 11, wherein the object transformation module  
2 comprises:

3           a database query module configured to retrieve a value from a database;

4           and

5           a value assignment module configured to assign the value to an object of the  
6           DOM.

7

8           20. The system of claim 11, wherein the object transformation module  
9 comprises:

10          an element replacement module configured to replace a first object of the  
11           DOM with a different second object.

12

13          21. An article of manufacture comprising a program storage medium  
14 readable by a processor and embodying one or more instructions executable by the  
15 processor to perform a computer-implemented method for processing a request for  
16 a document comprising at least one hypertext markup language (HTML) element,  
17 the method comprising:

18           parsing the requested document to generate therefrom a corresponding  
19           document object model (DOM) including at least one object;  
20           obtaining a transformation instruction directed to a first object of the DOM;

1 transforming the first object in accordance with the transformation  
2 instruction; and

3 flattening the DOM to generate therefrom a corresponding transformed  
4 document.

5

6 22. The article of manufacture of claim 21, wherein the obtaining step  
7 comprises:

8 reading a transformation instruction from a script file corresponding to the  
9 requested document.

10

11 23. The article of manufacture of claim 22, the method further comprising:  
12 receiving a request for a document from a client program; and  
13 identifying a script file corresponding to the requested document.

14

15 24. The article of manufacture of claim 23, wherein the client program  
16 comprises a Web browser.

17

18 25. The article of manufacture of claim 22, the method further comprising:  
19 receiving a request for a script file from a client program; and  
20 identifying a document corresponding to the requested script file.

1        26. The article of manufacture of claim 22, wherein the script file is  
2 included within a separate portion of the document.

3  
4        27. The article of manufacture of claim 22, wherein the script file and the  
5 document comprise logically separate data files.

6  
7        28. The article of manufacture of claim 21, the method further comprising:  
8              transmitting the transformed document to a client program.

9  
10        29. The article of manufacture of claim 21, wherein the transforming step  
11 comprises:

12              retrieving a value from a database; and  
13              assigning the value to an object of the DOM.

14  
15        30. The article of manufacture of claim 21, wherein the transforming step  
16 comprises:

17              replacing a first object of the DOM with a different second object.

## PROVIDING DYNAMIC WEB PAGES BY SEPARATING SCRIPTS AND HTML CODE

## ABSTRACT OF THE DISCLOSURE

A request reception module receives a request for an document stored within document server. A parsing module parses the requested document to generate therefrom a corresponding document object model (DOM) including at least one object. An instruction obtaining module obtains a transformation instruction directed to a first object of the DOM. An object transformation module transforms the first object in accordance with the transformation instruction. A flattening module flattens the DOM to generate therefrom a corresponding transformed document. A transmission module transmits the transformed document to a requesting client program.

File: personalinfo.asp

```
<html>
<head>
<title>Personal Information Update</title>
</head>
<body>
<table>
<form action="update.asp" method="post">
<tr>
<td>Name:</td>                                4A
<td>
| <% Response.Write("<input name='name' value='"
|   & rs("name") & '">" ) %>
| </td>
</tr>
<tr>
<td>Phone:</td>                                4B
<td>
| <% Response.Write("<input name='phone' value='"
|   & rs("phone") & '">" ) %>
| </td>
</tr>
<tr>
<td>E-mail:</td>                                4C
<td>
| <% Response.Write("<input name='email' value='"
|   & rs("email") & '">" ) %>
| </td>
</tr>
<td colspan="2" align="center">
<input type="Submit" name="Submit" value="Submit">
</td>
</tr>
</form>
</table>
</body>
</html>
```

2

4A

4B

4C

Fig. 1  
(prior art)

Personal Information Update

Name: ~2

Phone: :

E-mail: :

Fig. 2  
(prior art)

Personal Information Update

Name:  ~8

Phone:  :

E-mail:  :

Fig. 4  
(prior art)

File: personalinfo.html

```
<html>
<head>
<title>Personal Information Update</title>
</head>
<body>
<table>
<form action="update.asp" method="post">
<tr>
<td>Name:</td>
<td>6A
<input name='name' value='Jane Doe'>
</td>
</tr>
<tr>
<td>Phone:</td>
<td>6B
<input name='phone' value='408-555-1234'>
</td>
</tr>
<tr>
<td>E-mail:</td>
<td>6C
<input name='email' value='JaneDoe@IBM.COM'>
</td>
</tr>
<td colspan="2" align="center">
<input type="submit" name="submit" value="submit">
</td>
</tr>
</form>
</table>
</body>
</html>
```

~ 8

Fig. 3  
(prior art)

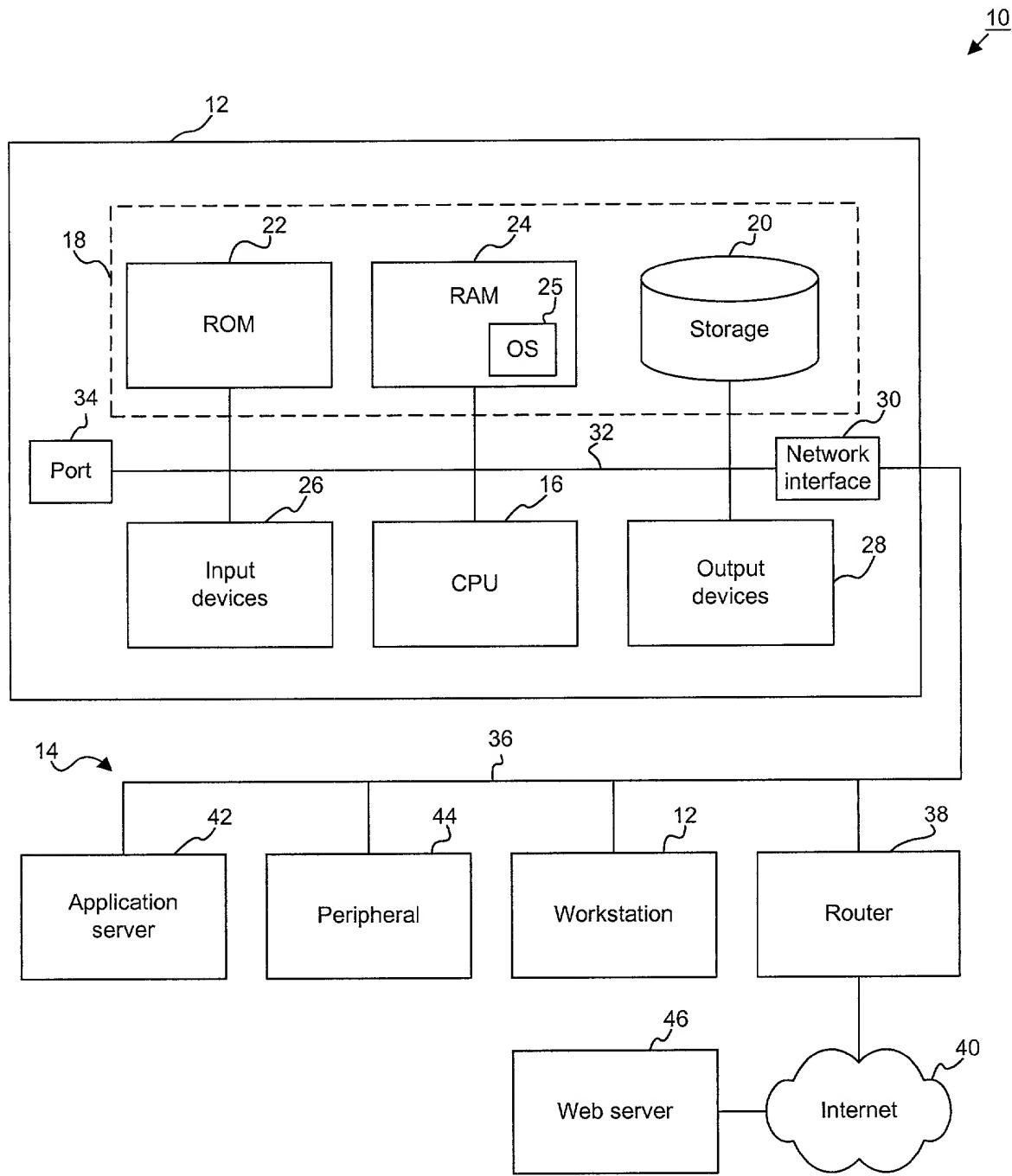


Fig. 5

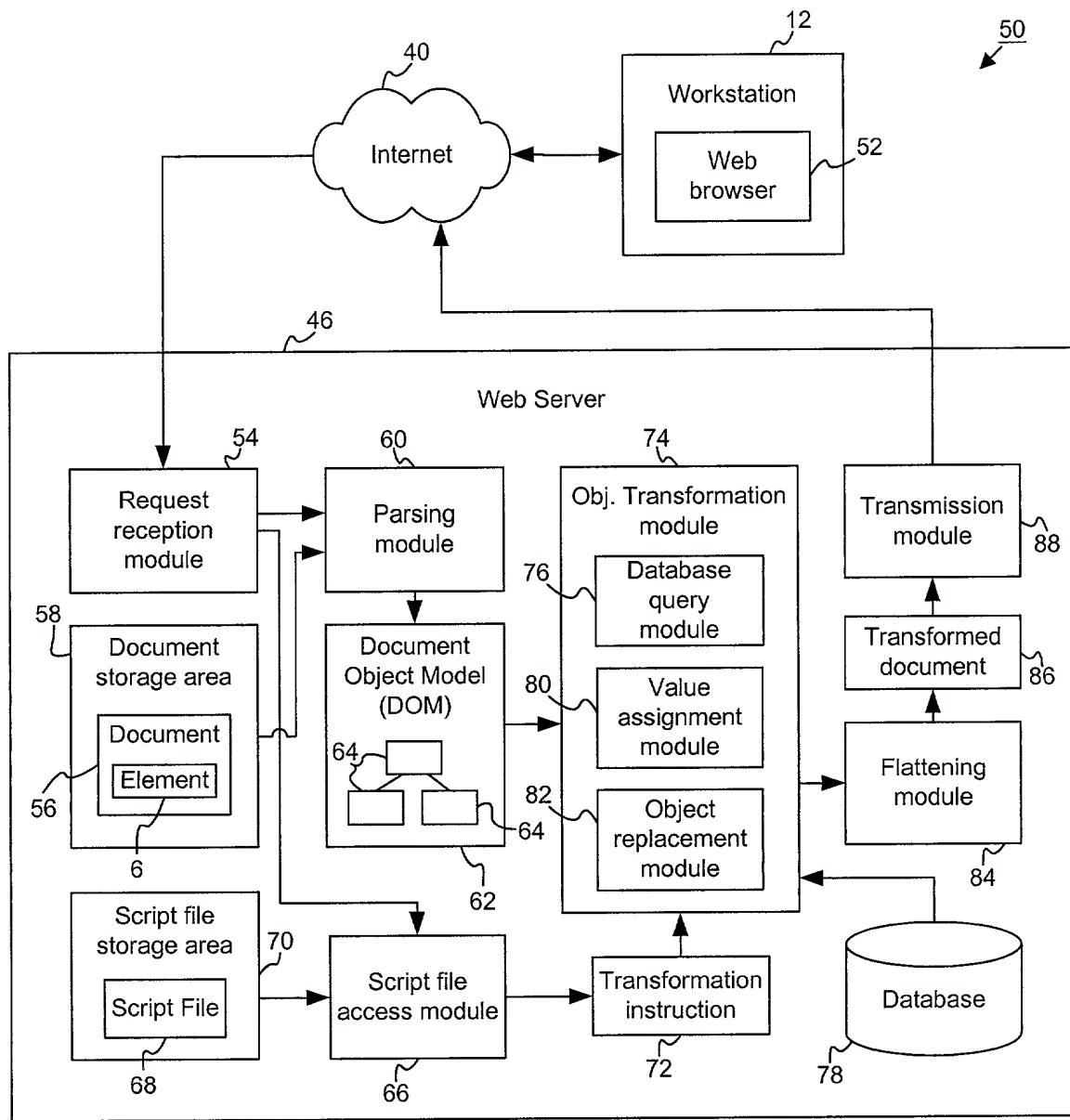


Fig. 6

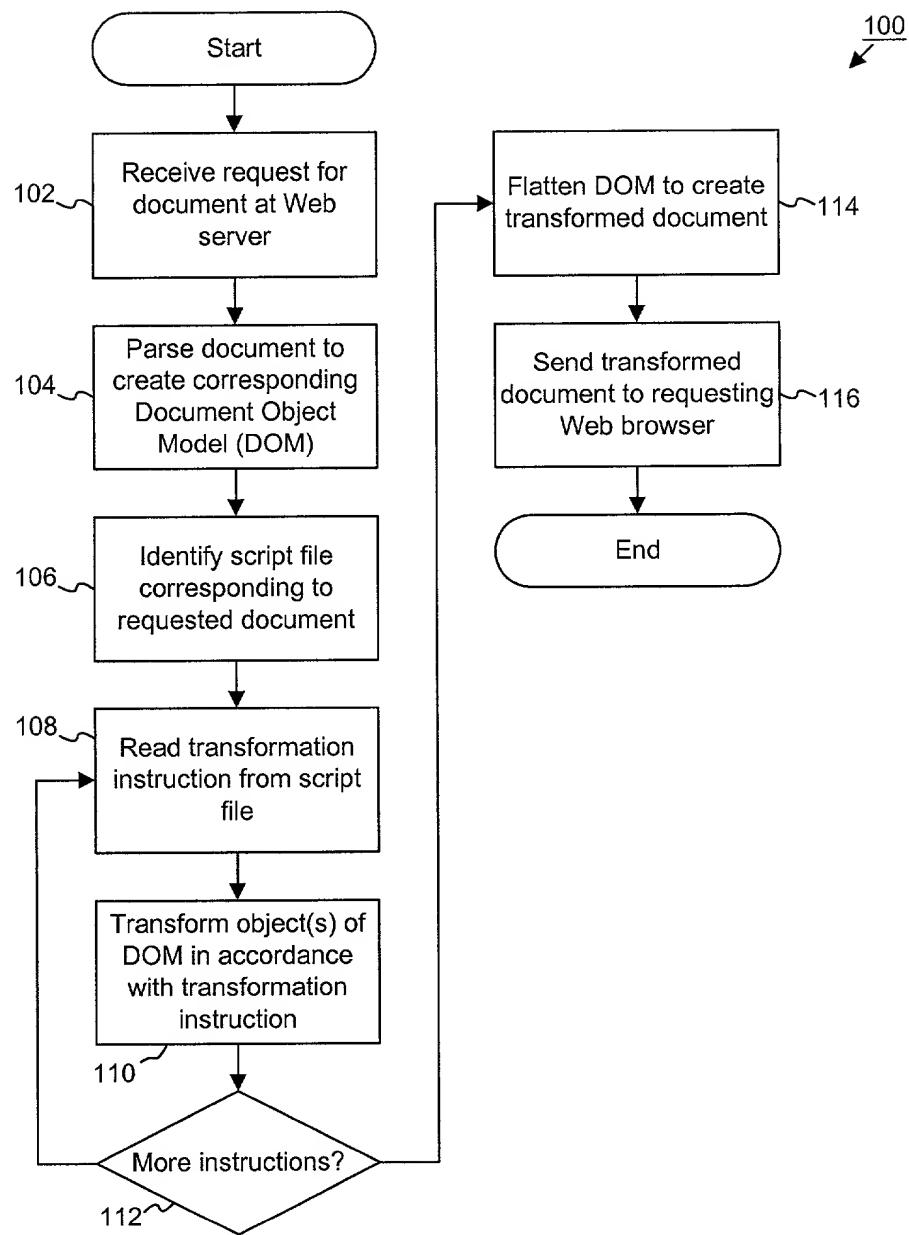


Fig. 7

File: personalinfo.html

```
<html>
<head>
<title>Personal Information Update</title>
</head>
<body>
<table>
<form action="update.asp" method="post">
<tr>
<td>Name:</td>
<td>
<input name='name' value=' '>
</td>
</tr>
<tr>
<td>Phone:</td>
<td>
<input name='phone' value=' '>
</td>
</tr>
<tr>
<td>E-mail:</td>
<td>
<input name='email' value=' '>
</td>
</tr>
<td colspan="2" align="center">
<input type="submit" name="submit" value="submit">
</td>
</tr>
</form>
</table>
</body>
</html>
```

56

6D

6E

6F

Fig. 8

**Personal Information Update**

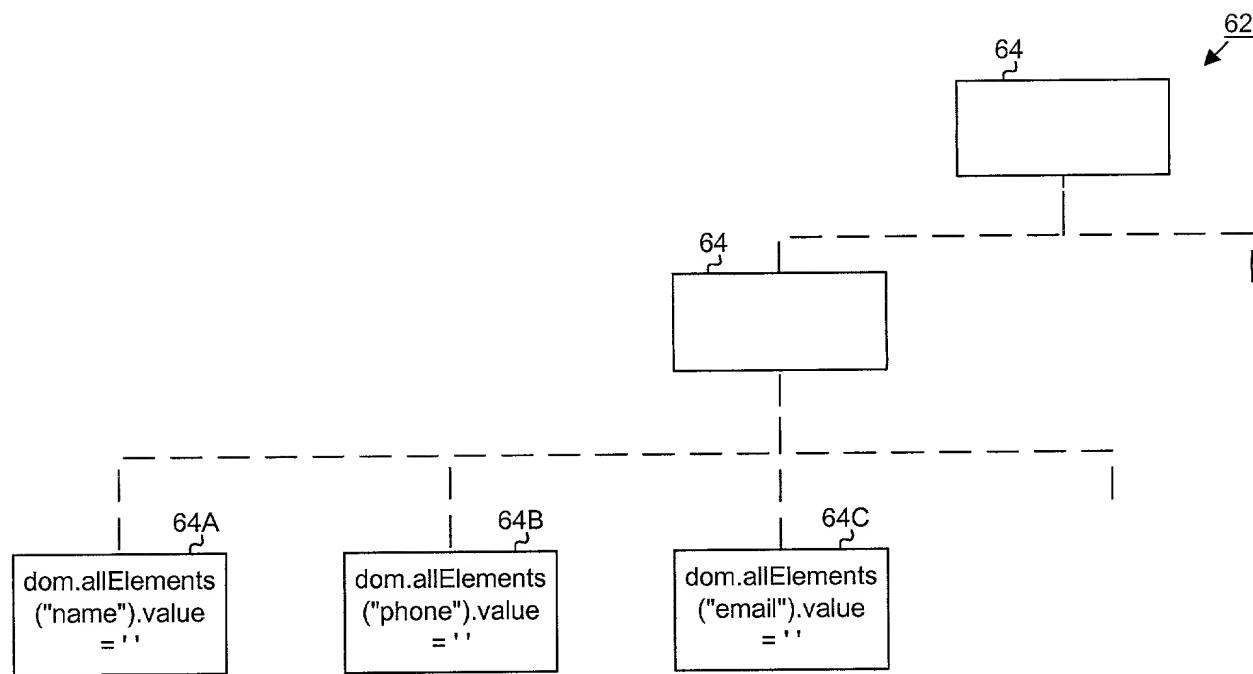
---

Name:

Phone:

E-mail:

**Fig. 9**



**Fig. 10**

File: personalinfo.scr

```
<* Code for creating recordset "rs" is omitted *>

[dom.allElements("name").value = rs("name")] 72A
[dom.allElements("phone").value = rs("phone")] 72B
[dom.allElements("email").value = rs("email")] 72C
```

Fig. 11

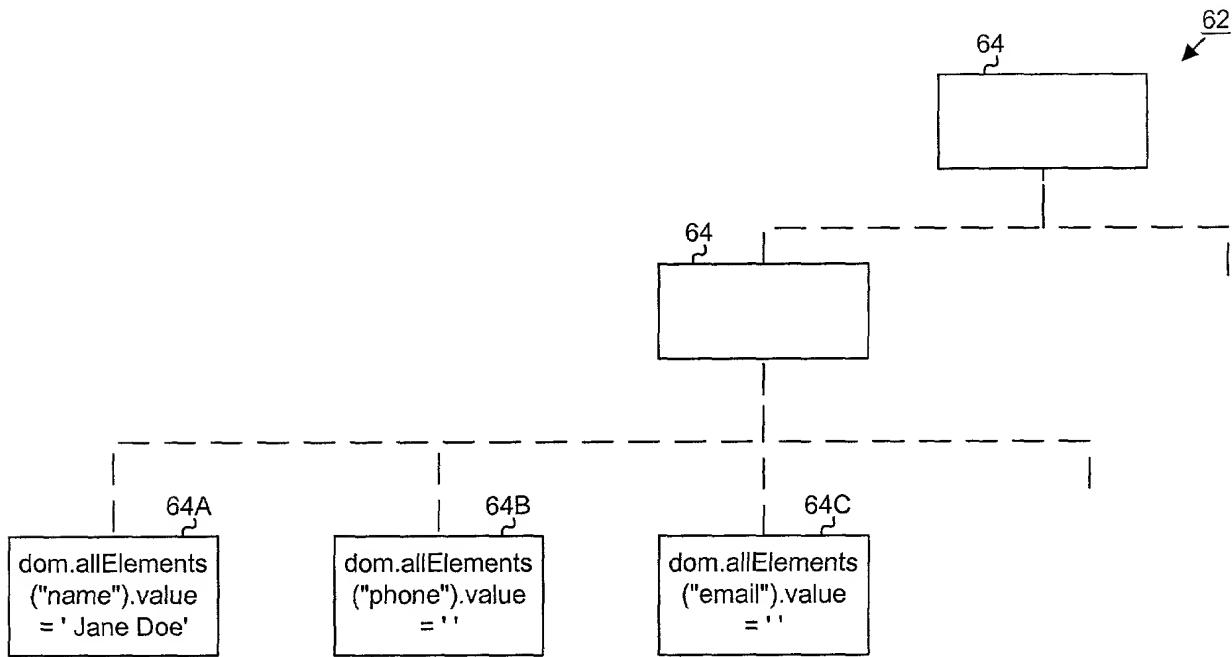


Fig. 12

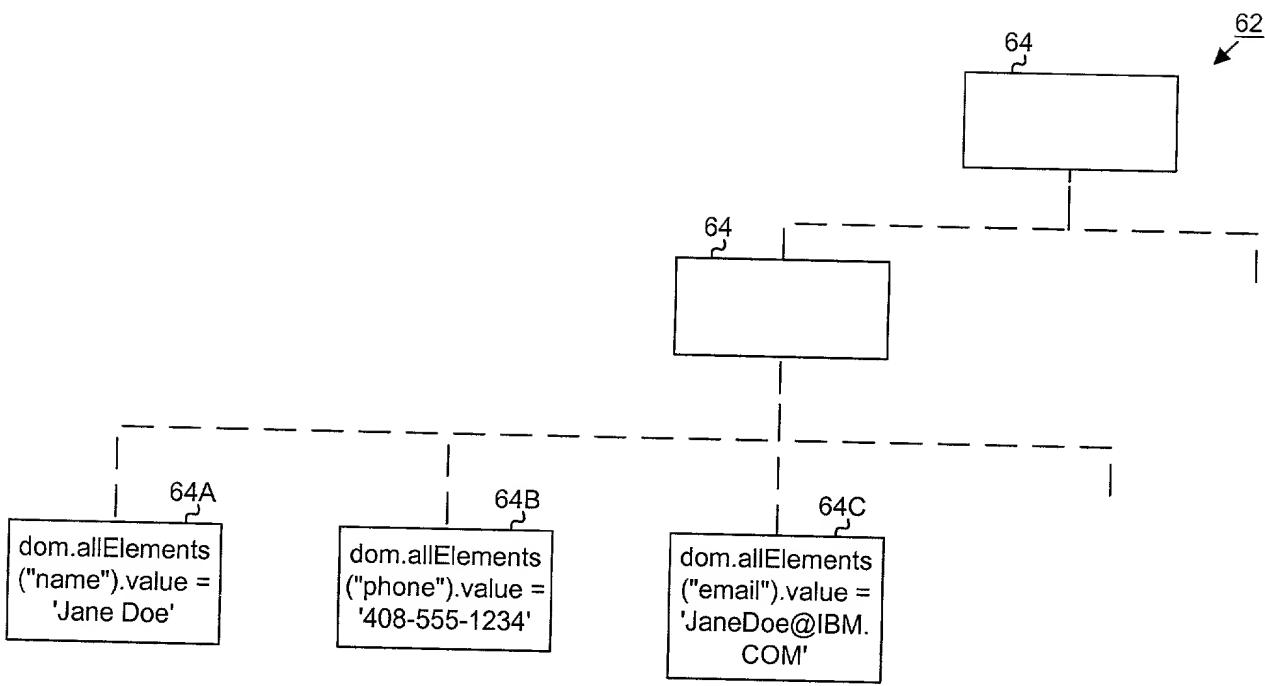


Fig. 13

File: personalinfo.html

```
<html>
<head>
<title>Personal Information Update</title>
</head>
<body>
<table>
<form action="update.asp" method="post">
<tr>
<td>Name:</td>
<td>
[<input name='name' value='Jane Doe'>]
</td>
</tr>
<tr>
<td>Phone:</td>
<td>
[<input name='phone' value='408-555-1234'>]
</td>
</tr>
<tr>
<td>E-mail:</td>
<td>
[<input name='email' value='JaneDoe@IBM.COM'>]
</td>
</tr>
<td colspan="2" align="center">
<input type="submit" name="submit" value="submit">
</td>
</tr>
</form>
</table>
</body>
</html>
```

~86

6A

6B

6C

Fig. 14

86

Personal Information Update	
Name:	<input type="text" value="Jane Doe"/>
Phone:	<input type="text" value="408-555-1234"/>
E-mail:	<input type="text" value="JaneDoe@IBM.COM"/>
<input type="button" value="Submit"/>	

Fig. 15

**DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION**

As a below named inventor, I hereby declare that:

My residence and citizenship are as stated below next to my name;

I believe I am the original , first and joint inventor of the subject matter which is claimed and for which a patent is sought on the invention entitled

**PROVIDING DYNAMIC WEB PAGES BY SEPARATING SCRIPTS AND HTML CODE**

the specification of which (check one)

X is attached hereto.  
was filed on \_\_\_\_\_  
as Application Serial No. \_\_\_\_\_  
and was amended on \_\_\_\_\_ (if applicable).

I hereby stat that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, code of Federal Regulations, Section 1.56.

I hereby claim foreign priority benefits under Title 35, united States Code, Section 119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

Prior Foreign Application(s)	Priority Claimed
none (Number)	Yes _____ No _____
(Country)	(Day/Month/Year filed)

I hereby claim the benefit under Title 35, Untied States Code, Section 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, Section 112, I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56, which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

none (Application Serial No.)	(Filing Date)	(Status) (patented, pending, abandoned)
----------------------------------	---------------	---

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

**POWER OF ATTORNEY:** As named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. (list name and registration number)

Romualda Strimaitis: 35,697  
Timothy M. Farrell: 37,321  
Ingrid M. Foerster: 36,511  
Prentiss W. Johnson: 33,123  
Christopher A. Hughes: 26,914  
John E. Hoel: 26,279  
Edward A. Pennington: 32,588  
Joseph C. Redmond, Jr.: 18,753  
Craig J. Madson: 29,407  
L. Craig Metcalf: 31,398

Evan R. Witt: 32,512  
A. John Pate: 36,234  
Gary D.E. Pierce: 38,019  
David B. Fonda: 39,672  
John R. Thompson: 40,842  
Brian C. Kunzler: 38,527  
Barton W. Giddings: 41,036  
Hal D. Baird: 42,284  
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Salt Lake City, Utah 84101  
Telephone: (801) 537-1700

Full name of sole or first joint-inventor: HongHai Shen

Inventor's signature:



Date:

2/17/2000

Residence: 1302 Oak Knoll Drive, San Jose, California 95129

Citizenship: China

Post Office Address: Same

Full name of second joint-inventor: Yudong Sun

Inventor's signature:

Date:

Residence: 6340 Snowberry Court, Gilroy, California 95020

Citizenship: China

Post Office Address: Same

**DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION**

As a below named inventor, I hereby declare that:

My residence and citizenship are as stated below next to my name;

I believe I am the original , first and joint inventor of the subject matter which is claimed and for which a patent is sought on the invention entitled

**PROVIDING DYNAMIC WEB PAGES BY SEPARATING SCRIPTS AND HTML CODE**

the specification of which (check one)

is attached hereto.  
 was filed on \_\_\_\_\_  
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Prior Foreign Application(s)

Priority Claimed

none (Number)	(Country)	(Day/Month/Year filed)	Yes <input type="checkbox"/>	No <input type="checkbox"/>
------------------	-----------	------------------------	------------------------------	-----------------------------

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none (Application Serial No.)	(Filing Date)	(Status) (patented, pending, abandoned)
----------------------------------	---------------	---

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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Ingrid M. Foerster:	36,511	Gary D.E. Pierce:	38,019
Prentiss W. Johnson:	33,123	David B. Fonda:	39,672
Christopher A. Hughes:	26,914	John R. Thompson:	40,842
John E. Hoel:	26,279	Brian C. Kunzler:	38,527
Edward A. Pennington:	32,588	Barton W. Giddings:	41,036
Joseph C. Redmond, Jr.:	18,753	Hal D. Baird:	42,284
Craig J. Madson:	29,407	Kory D. Christensen:	43,548
L. Craig Metcalf:	31,398		

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 Salt Lake City, Utah 84101  
 Telephone: (801) 537-1700

Full name of sole or first joint-inventor: HongHai Shen

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Inventor's signature: \_\_\_\_\_ Date: \_\_\_\_\_

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Residence: 1302 Oak Knoll Drive, San Jose, California 95129

---

Citizenship: China

---

Post Office Address: Same

---

Full name of second joint-inventor: Yudong Sun

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Inventor's signature:  Date: 2/16/00

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Residence: 6340 Snowberry Court, Gilroy, California 95020

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Citizenship: China

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